Julia Pro Dual Nozzle Printer
User manual

Wadhwani Electronics Lab

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Contents

1 Design and Specification

Julia Pro Dual Nozzle 3D Printer is developed by Fractal Works . Its quick swap-able dual nozzle enables to print multiple objects and shapes at the same time. Compatible materials are PLA, PVA and ABS for the printer. Printer can withstand upto 270 °C nozzle temperature and 150 °C build plate temperature. Also there is a passive heated chamber.

2 Introduction to Software

Fusion 360 is a cloud-based 3D modeling CAD software platform for product design and manufacturing. In this software 3D geometry of the object to be printed is visualized.
Fracktory is machine specific software for selecting the parameters related to the Julia Pro Dual Nozzle printer like temperature, material, print speed etc.

2.1 Fusion 360

We are going to demonstrate printing of ring with 20 mm outer diameter and 18 mm inner diameter. Steps to follow for using Fusion 360 is given below :

- Login to Fusion 360

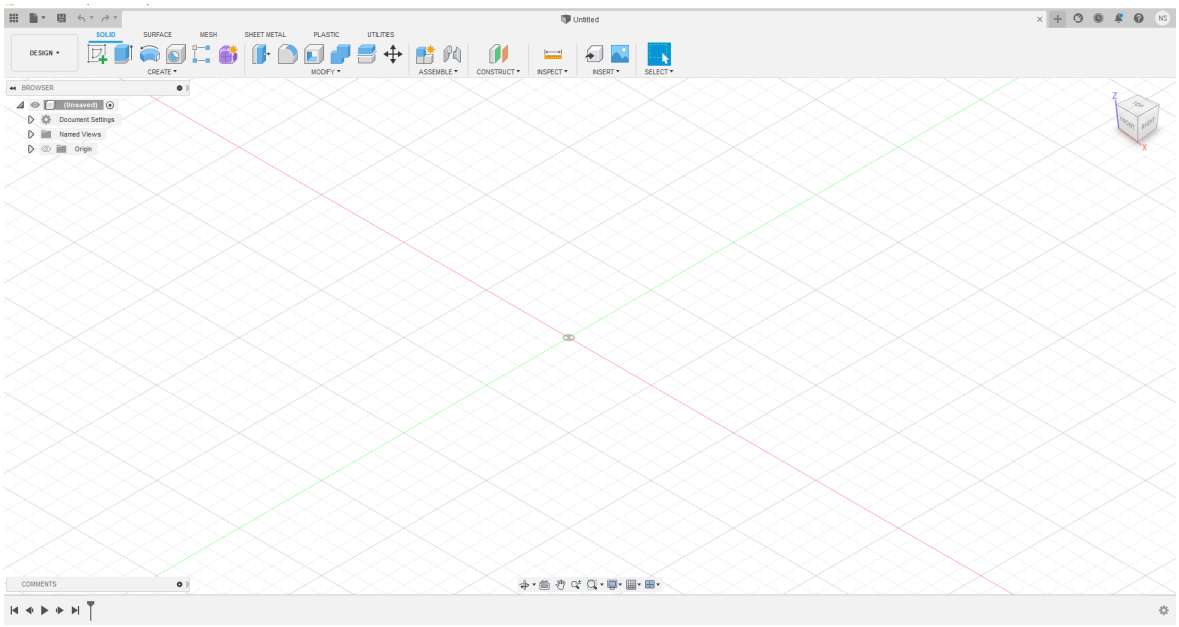


Figure 1: Fusion360 view after login page

- The **view cube** allows you to manipulate the model in a more structured way. By clicking either on the corners, edges, or faces of the cube the model will re-oriented inside the canvas. This makes it easy to switch between standard views. If the user clicks the arrow on the bottom right of the view cube, a drop-down menu appears that provides more options to control the view.

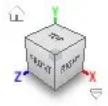


Figure 2: view cube

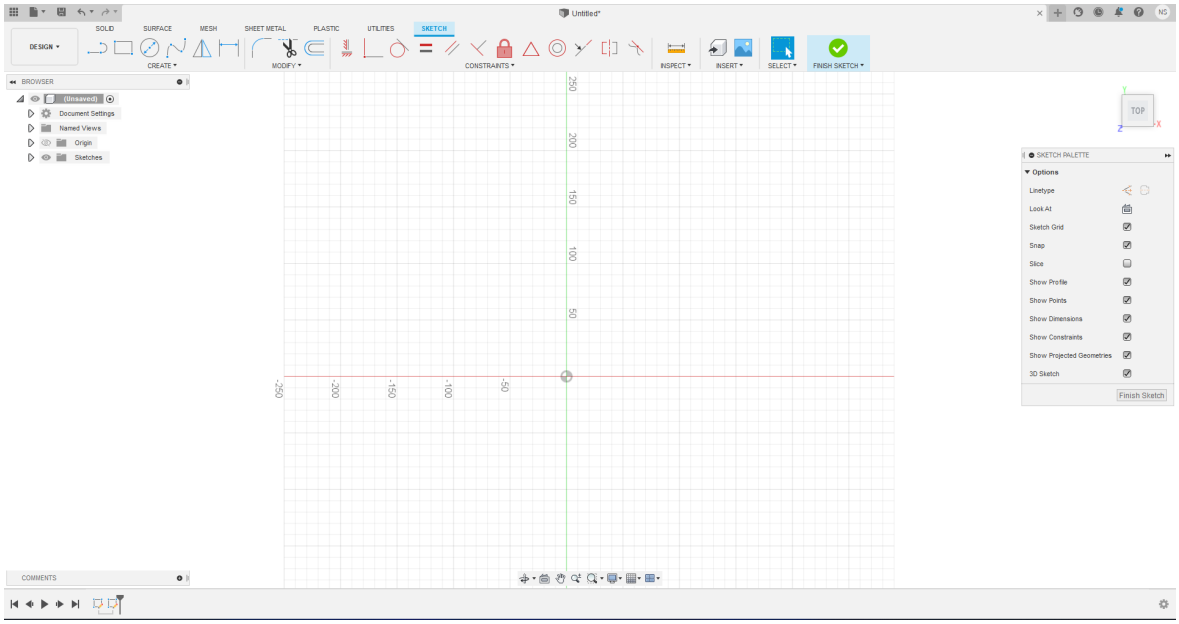


Figure 3: Fusion360 view after selection top plane and sketch tab

- Click on create sketch

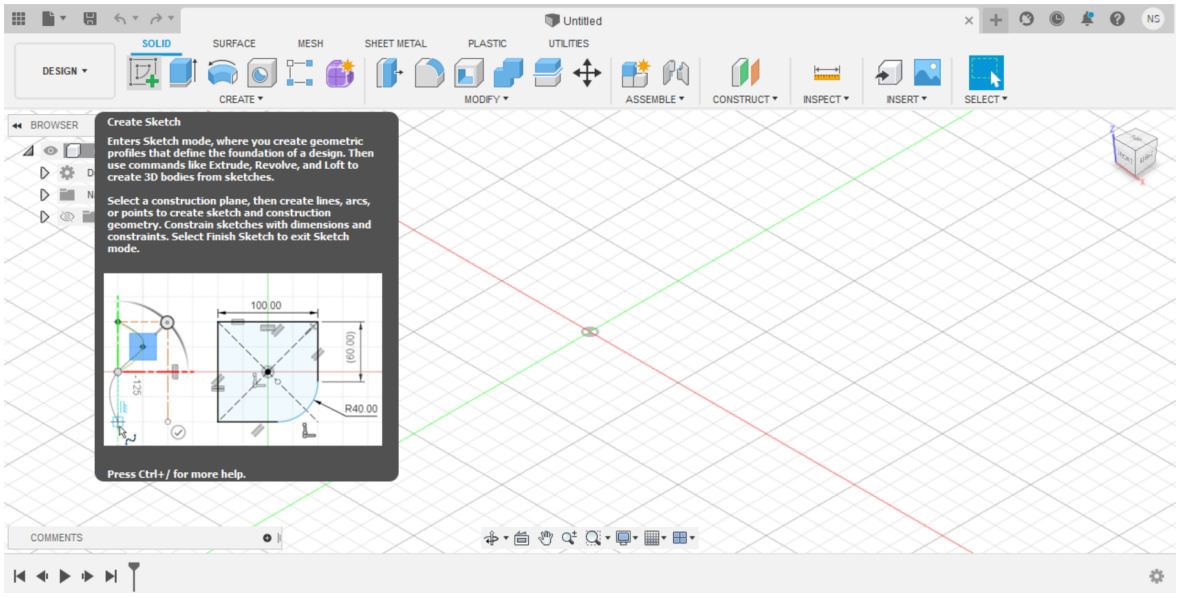


Figure 4: create sketch button

- Select a plane (while revolving one can see three planes)
- Sketch circles of 18mm and 20 mm diameter. Search over internet different ways in which you can draw a circle.

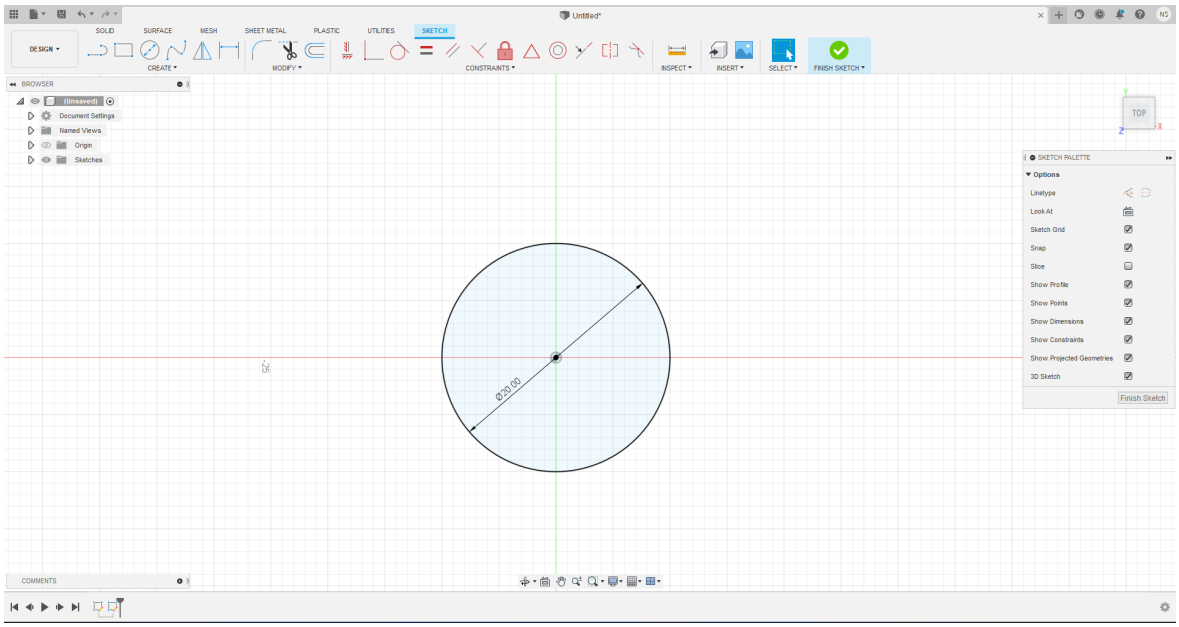


Figure 5: Fusion360 view after drawing one circle around origin

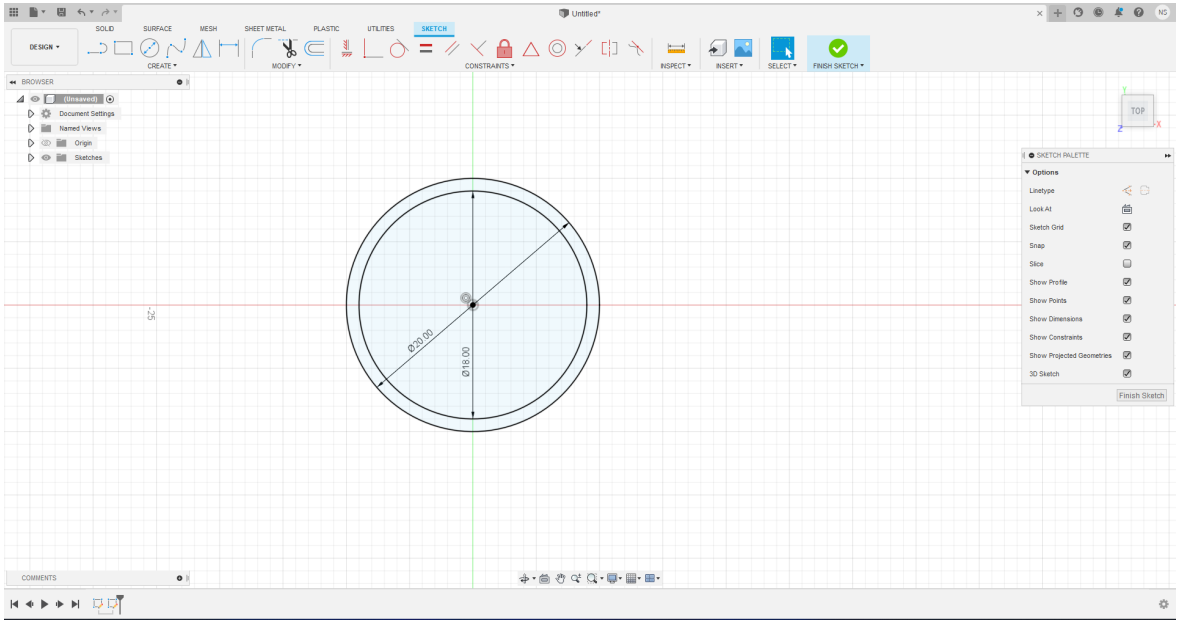


Figure 6: Fusion360 view after drawing two concentric circles around origin

- Finish Sketch

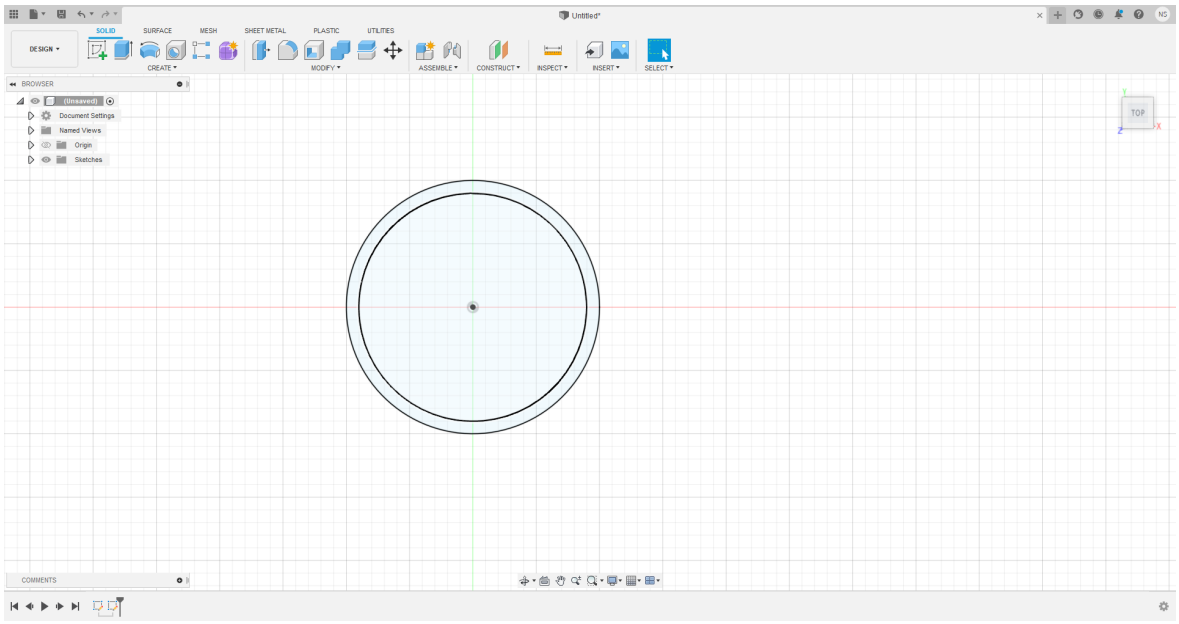


Figure 7: Fusion360 view after Finishing(Measurements Disappear)

- In Solid tab,extrude on closed surface using extrude button and specify dimension say 2 mm (In this step the depth of the 3D object is defined)

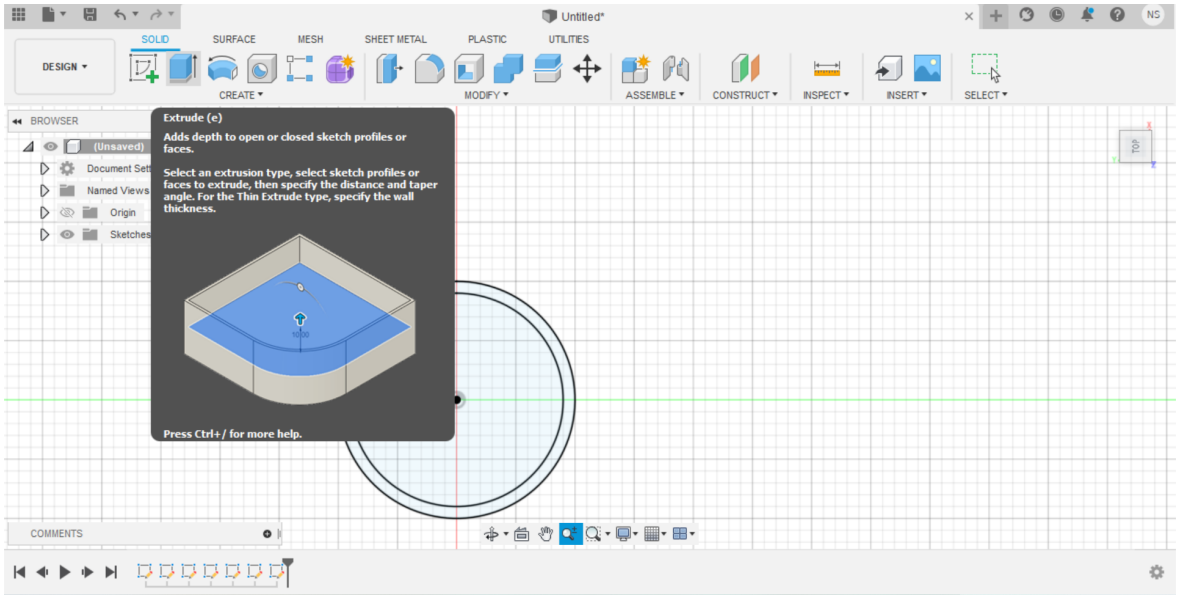


Figure 8: Extrude Button

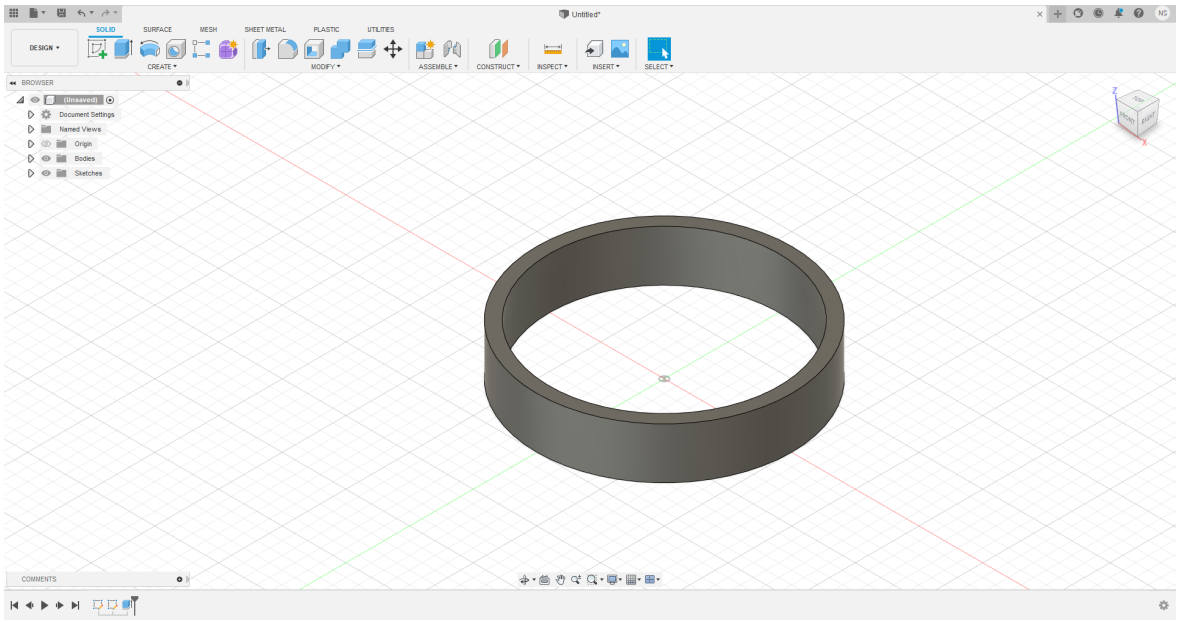


Figure 9: Fusion360 view after extruding by use of extrude option inside solid tab

- In Sheet Metal tab use Fillet tab to smoothen the edges. (In this step the edges are smoothened out)

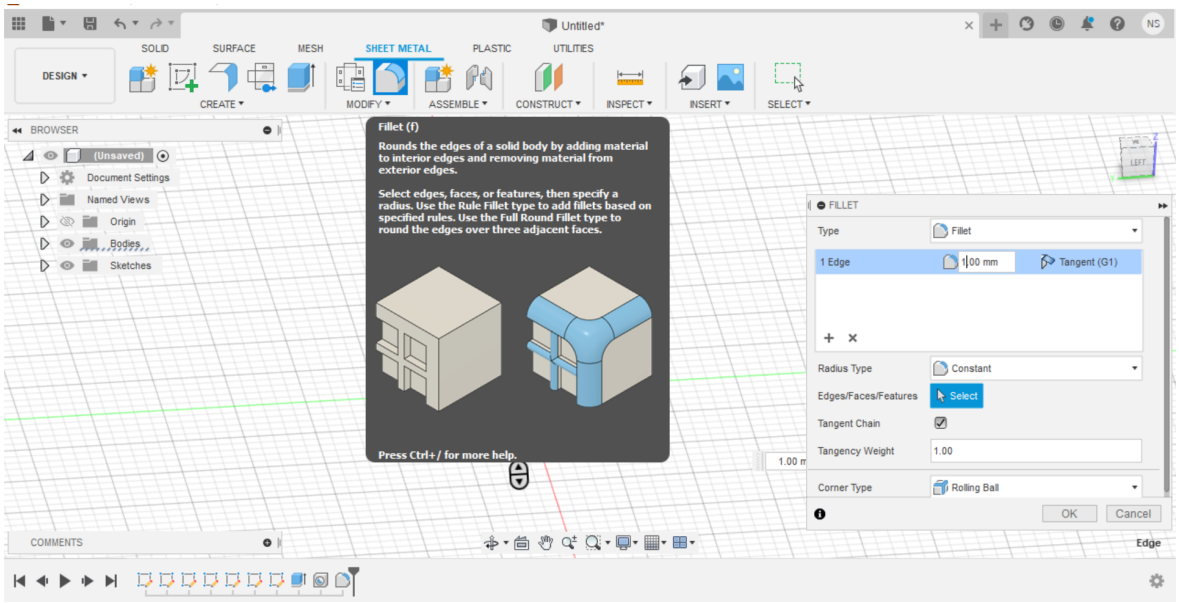


Figure 10: Fillet Button

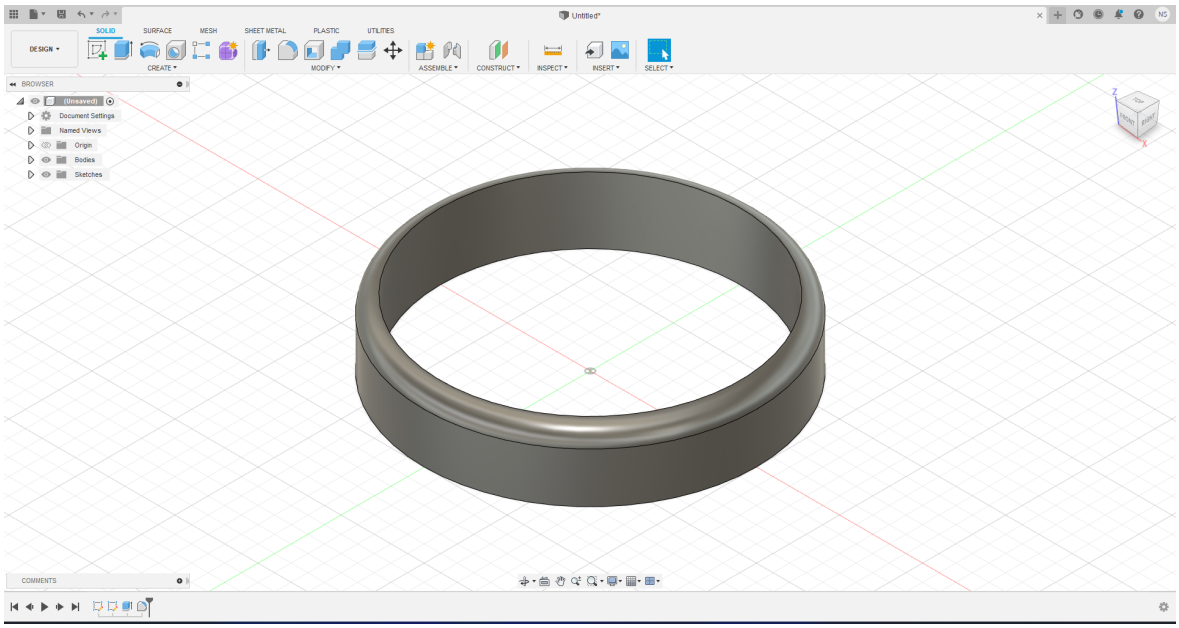


Figure 11: Fusion360 view after top edge smoothening by 1mm fillet

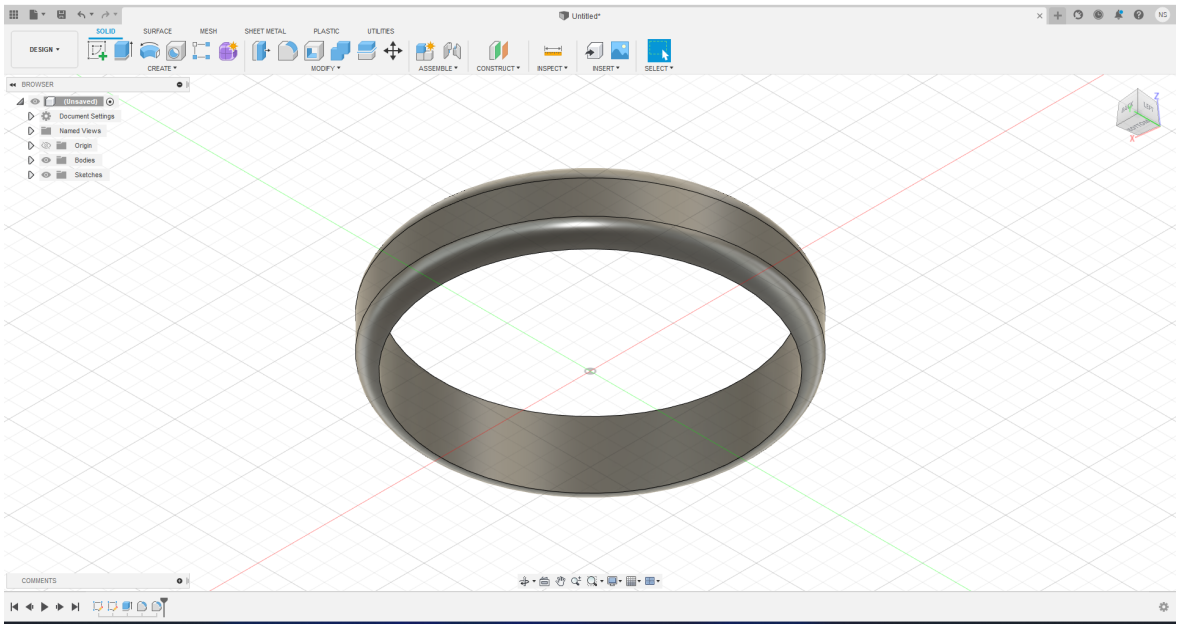


Figure 12: Fusion360 view after bottom edge smoothening by 1 mm fillet

- Solid - Hole of 1 mm dimension (In this step a hole of 1 mm is drilled on front side)

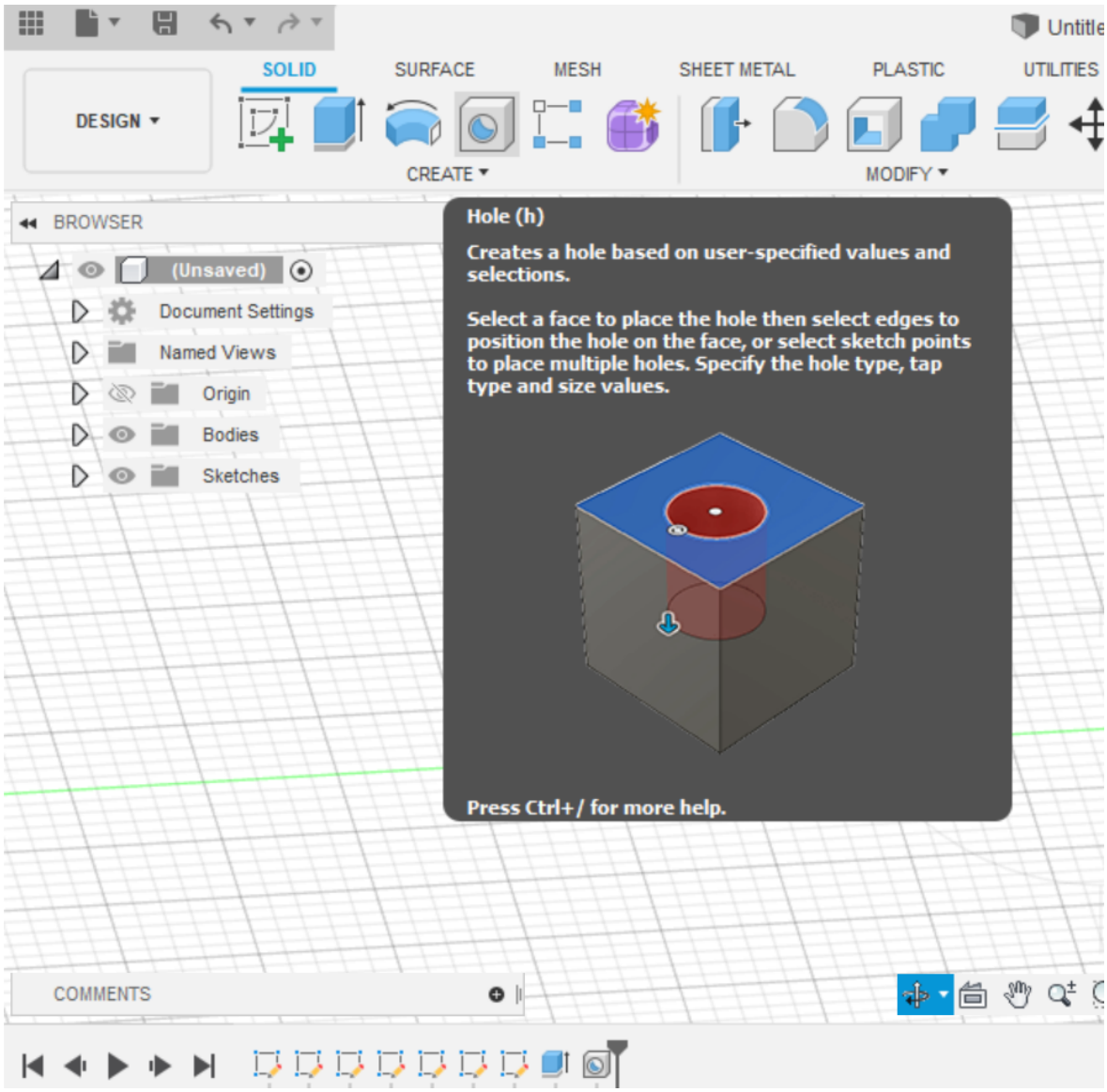


Figure 13: Hole Button

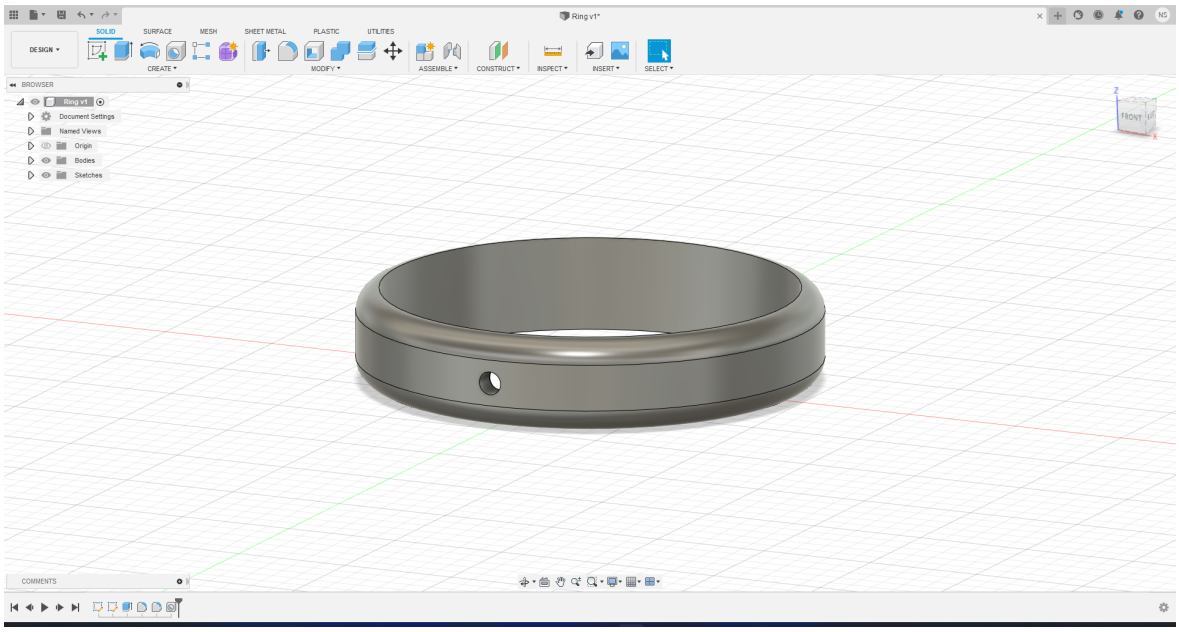


Figure 14: Fusion360 view after hole is drilled

- Edit the sketch and change the dimension.
  Note : After changing dimensions its visible that earlier hole cannot penetrate through entire ring.

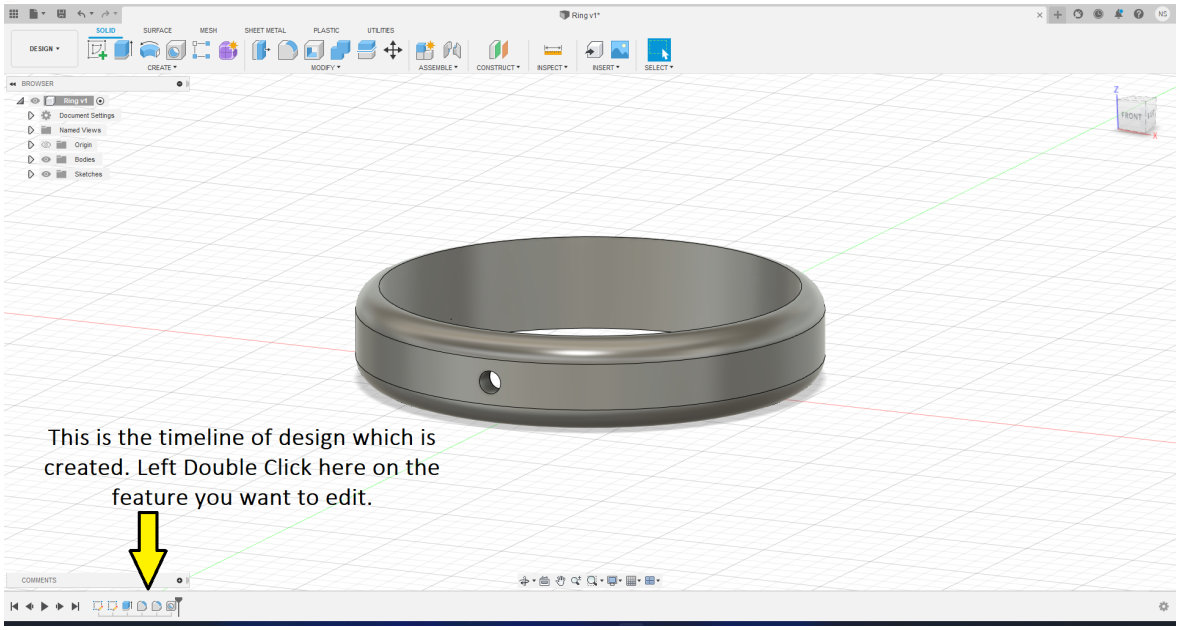


Figure 15: Timeline and Editing

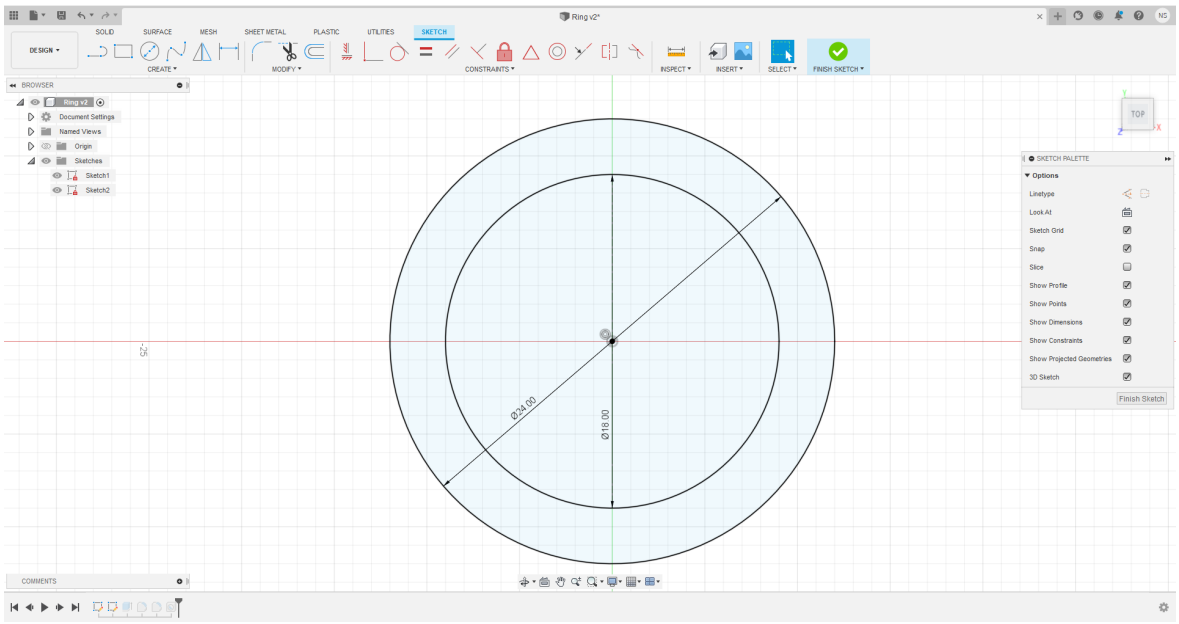


Figure 16: Fusion360 view after changing dimension

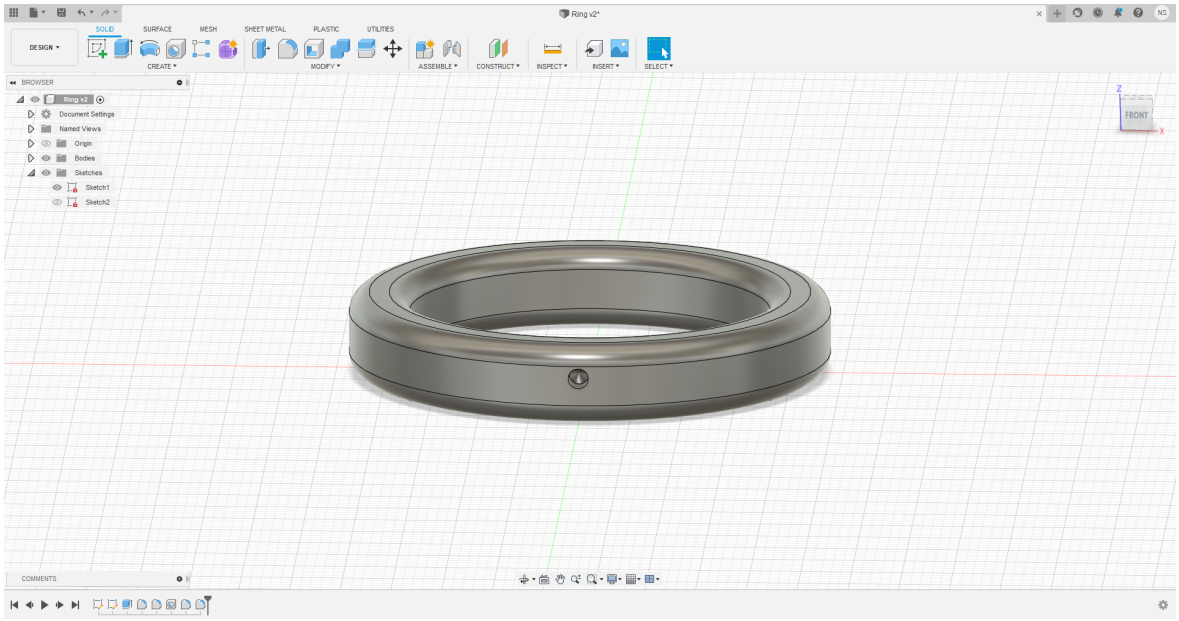


Figure 17: Fusion360 view after increasing width of ring

- Fillet inner edge by 1 mm

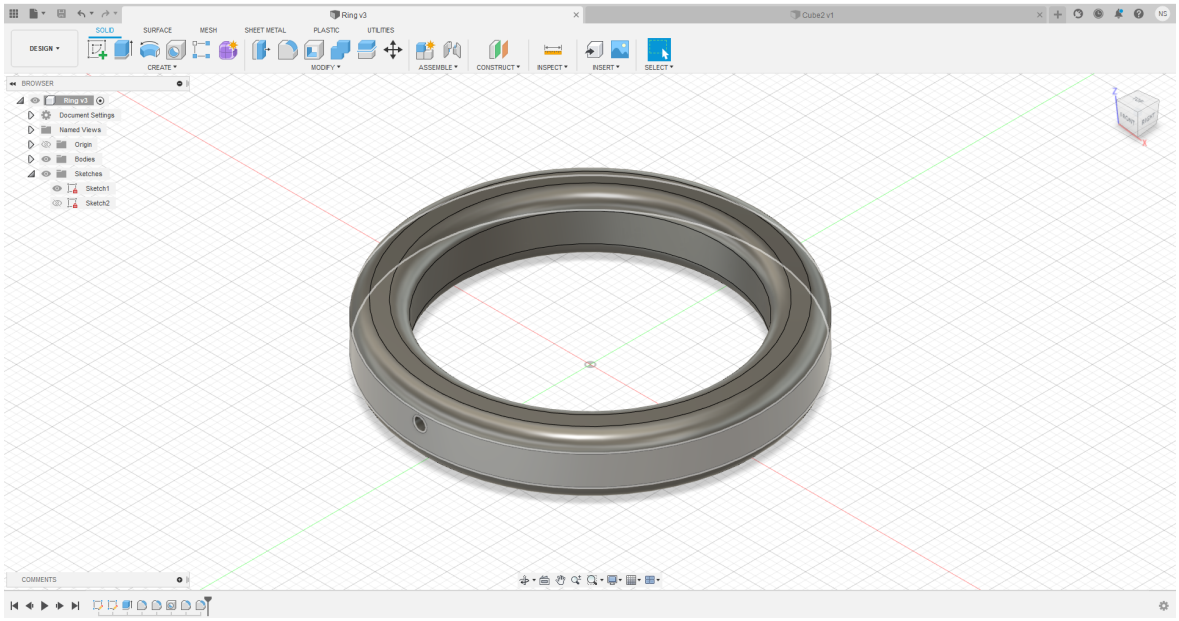


Figure 18: Fusion360 view after inner edge smoothening by 1mm fillet

- The design file can be exported as .stl or .obj format

2.2 Fracktory

This software is used to set parameters for the Julia Pro Dual Nozzle Printer for printing the 3D object design developed in Fusion 360.

There are two extruders shown in the Fracktory (i.e. Extruder 0 and Extruder 1, refer figure(19)) each one represents one of the nozzle in the printer. We select the extruder using which we need to print the 3D design. In the below example Extruder 0 is selected for printing the objects. While printing multi-colored object both the filaments can be used simultaneously. If both nozzle needs to be used the both then extruders are selected. Using this software we can select the material used for printing the object.

For the Julia Pro Dual Nozzle printer PVA, PLA and ABS material can be used. Nylon is not compatible with our current setup. Usually PLA is used to print objects in WEL setup. PVA material is usually used for support structures these are water soluble.

Options available in the software by using Recommended settings:

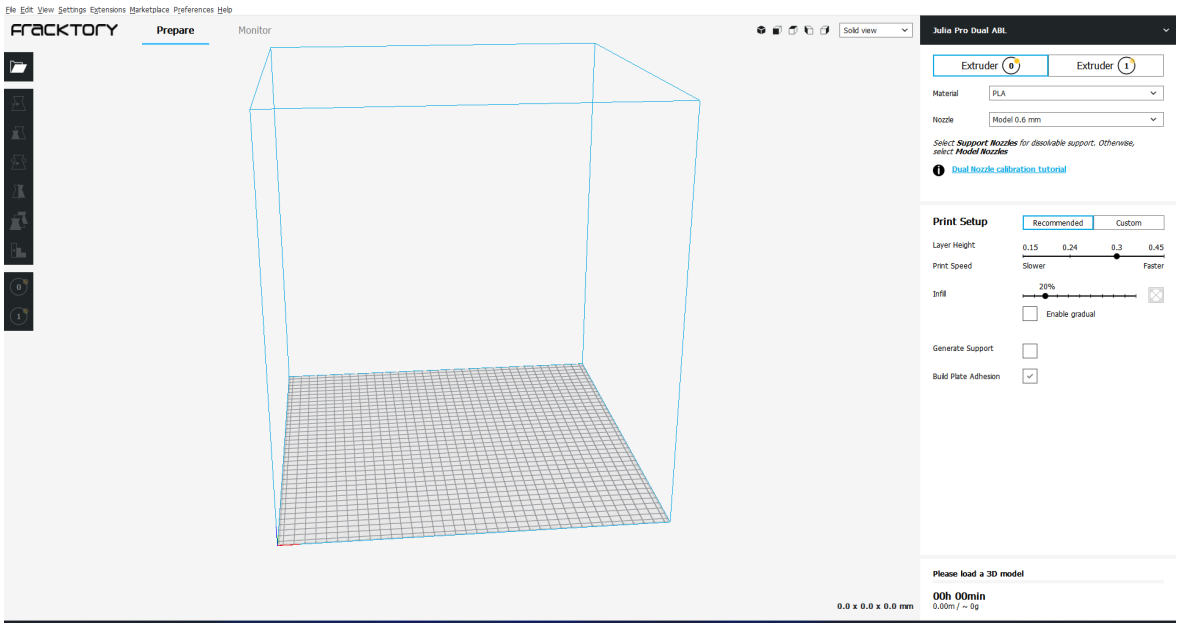


Figure 19: Fracktory Screen view after opening tool

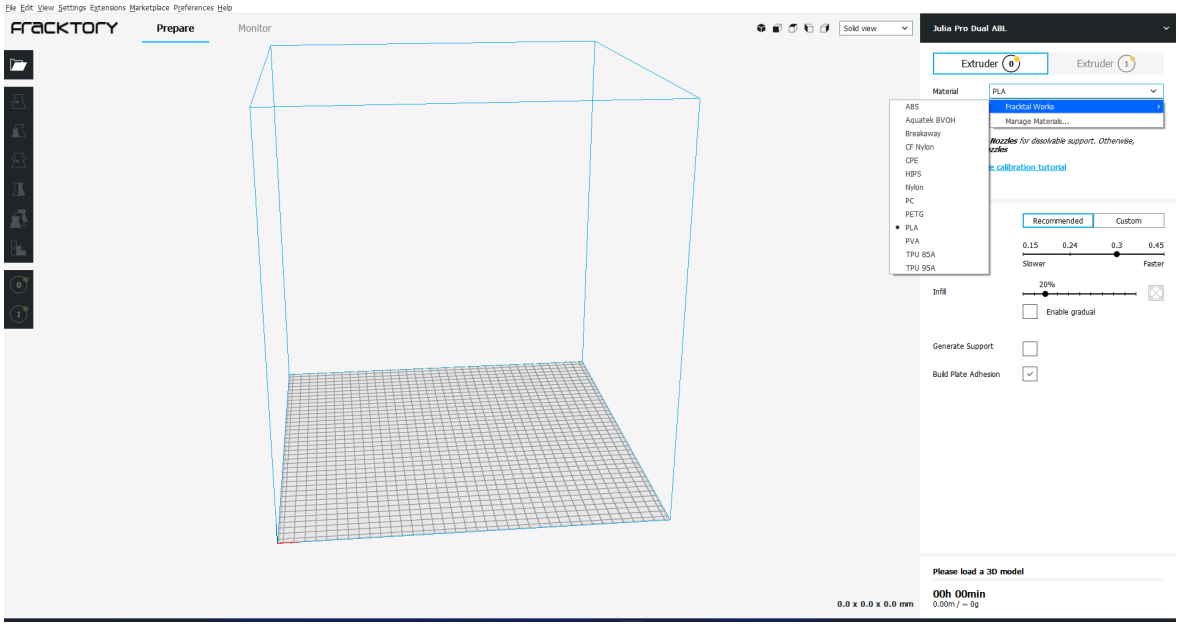


Figure 20: Fracktory Screen view during material selection

- Add the .stl file
- X,Y,Z coordinate is fixed based on where to print the object on the bed
- Move the object X,Y,Z coordinates

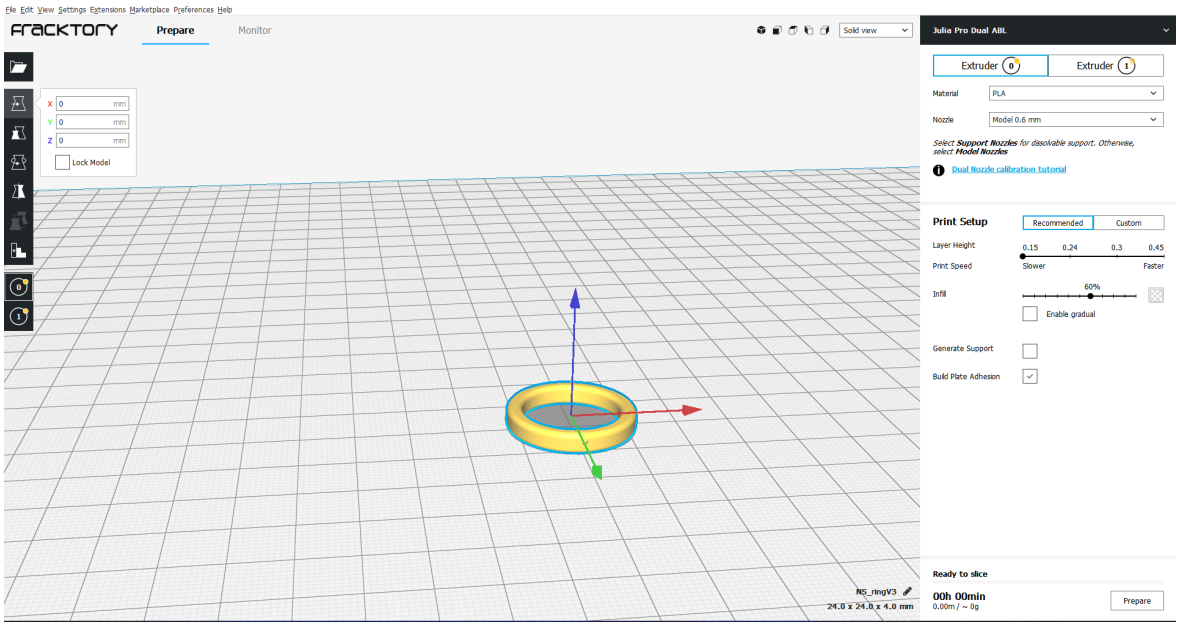


Figure 21: Fracktory Screen view for X,Y,Z coordinates selection

- Scaling : uniformly or non uniformly scale the object to required size

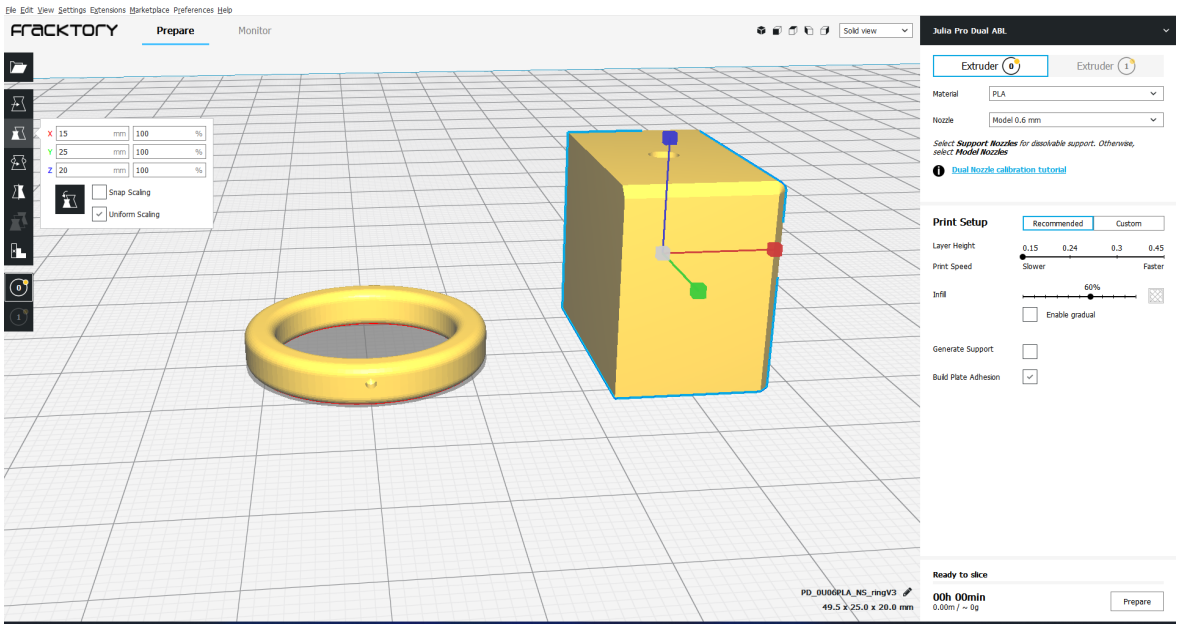


Figure 22: Fracktory Screen view to select scaling

- Rotate : Rotate the 3D structure in such a way that maximum surface area lies on the bed in order to print the object properly as shown in above figure.

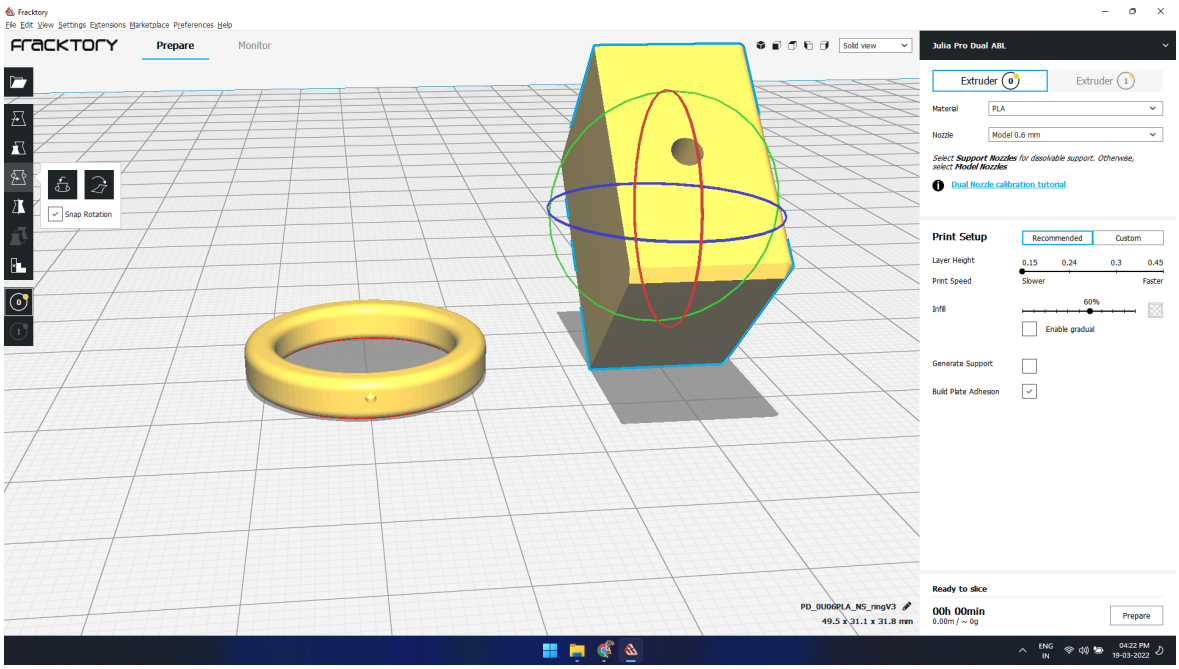


Figure 23: Fracktory Screen view while using rotate option

- Mirror : Used to change the orientation

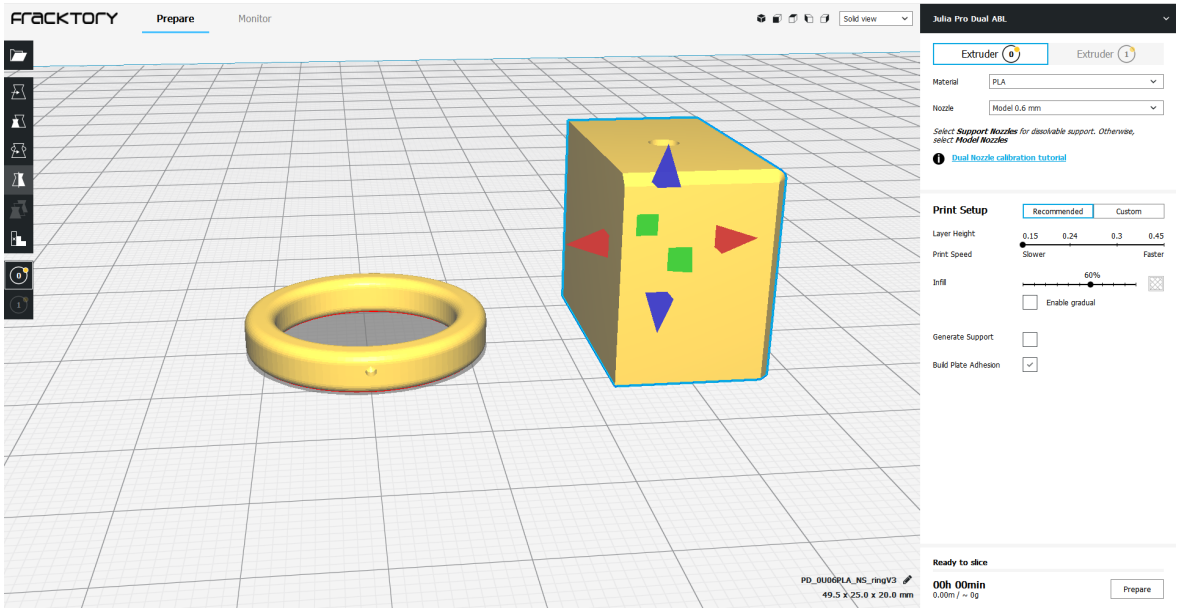


Figure 24: Fracktory Screen view while using mirror option

- For printing multiple objects of the same design right click and increase number
- Select nozzle to 0.6 mm (The printer has nozzle diameter between 0.4mm to 1.2 mm. For optimum fine printing 0.6 mm nozzle diameter is chosen.)

- Select the layer height : the lower the layer height the finer the print but requires more time to print

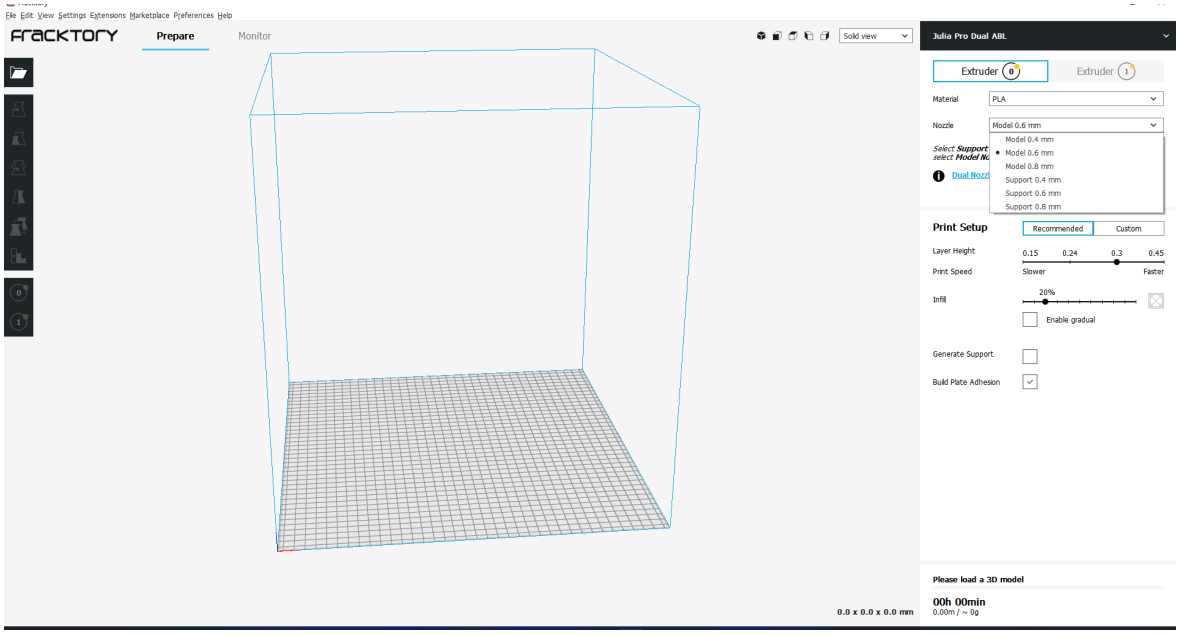


Figure 25: Fracktory Screen view while selecting nozzle size,layer height and infill

- Infill : Density of material that need to filled
- Click on Prepare to generate the gcode. The extrude temperature setting will be automatically controlled by recommended settings.
- X-Ray view : shows the X-ray view of the object

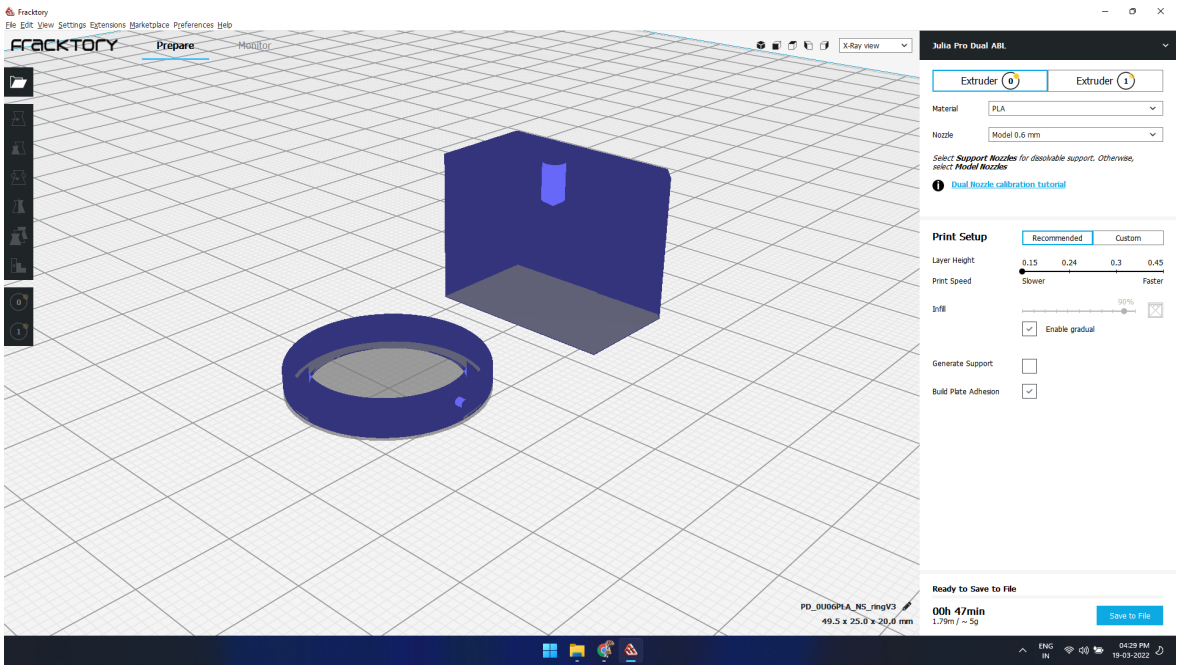


Figure 26: Fracktory Screen view showing X-Ray view

- Layer View : shows how the object and the support is being prepared layer by layer.

Some additional options with regard to infill pattern, nozzle and bed temperature, support and print speed will be available in custom setting

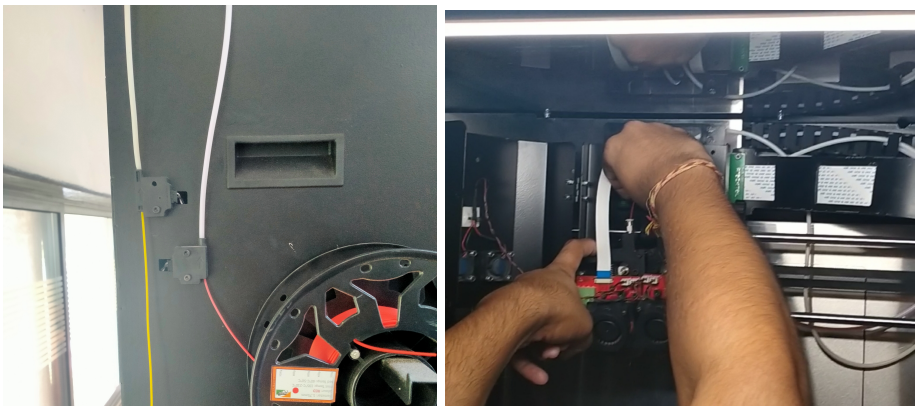
3 Operating Procedures

Before the calibration the filament is inserted in the nozzle. This is done by inserting the filament into the white tube through the joint as shown in figure(27a). Then the filament need to be inserted into the nozzle after opening the case and by pressing lever on the sides as shown in figure(27b). In order to load the filament to the nozzle :

- Go to Printer menu
- Select Control
- Select Filament
- Select Change Filament
- Check whether the filament name mentioned is appropriate (in our case PLA material is used)
- Select Load

A video link of the above procedure is given below :-

Loading Filament:Part-1.
Loading Filament:Part-2.



(a) Inserting filament to the tube (b) Inserting filament to the nozzle

Figure 27: Inserting filament into the nozzle

Printer nozzle and bed temperature is set as 210 °C and 65 °C for PLA material. For setting the nozzle and bed temperature :

- Go to Printer menu
- Select Control
- Select Temperature
- Select nozzle 0 or 1 appropriately
- Adjust bed temperature and nozzle temperature using up-down arrow
- Set bed temperature to 65 °C and nozzle temperature to 210 °C

A video link of above procedure is given below :-

Nozzle and Bed Temperature Adjustment Demo.

Some of the filament at the end of the nozzle is drained out so as to get started with a smooth printing. After this the nozzle and bed temperature is made normal in order to do calibration of the bed. A video link of above procedure is given below :-

Nozzle Drain Demo.

3.1 How to calibrate machine

The bed alignment is corrected with the help of screws and LEDs. The procedure is as follows :

- Go to Printer menu
- Select Calibrate
- Select Calibration Wizard
- As the nozzle moves at the first point, tighten or loosen screw at the bottom of bed until the red LED light at bottom of bed stops blinking and glows constantly.

- Repeat the above step for each of the points
- Check nozzle and bed alignment at the end

A video link of above procedure is given below :-

Bed Alignment-1.
Bed Alignment-2.
Bed Alignment-3.

It is ideal to have slight friction between the nozzle and bed for proper 3D printing of the object which is checked by using a paper and adjusting the nozzle position. Once this is fixed the system is set for auto calibration of 16 points on the bed. A link of above procedure is given below :-

Friction check.

After that the design file is loaded by mounting the USB memory device that contains the gcode design file to the printer. Put some glue (can use fevistick as the adhesive) on the bed surface where the object will be printed so that it gets off the bed easily after printing. The object is printed from the design file.

- Mount USB memory device to the printer
- Go to Printer menu
- Select Print
- Select USB
- Using up-down arrow select the corresponding gcode file to load
- Press the print to start the printing process
- The window will show the print time and time left for printing at this stage
- Once the printing process is done let the printer cool down, after that remove the model from the bed surface carefully.
- Cut out the brim of the model and supports carefully with the help of cutter to get the final printed object

A link of above procedure is given below :-

Design file upload.
Printing-1(Prep).
Printing-2(Machine Printing).

4 Do's and Dont's

Do's :

- Nozzle and bed must be clean, dust particles may deteriorate the model
- Ensure to calibrate before operating.
- Ensure nozzle and bed temperatures are set appropriately to make the material flow smooth

- Drain nozzles once before calibration.
- Ensure if the model to be printed and the model in the display of the printer monitor are same before printing the object

Dont's :

- Do not touch the nozzle directly.
- Do not disturb the nozzle or bed while printing as it will be at high temperatures.

Figure 28: Printed Objects

5 Useful Links

- Modifying Design
- Fusion 360 Tutorials
- Basics of Fusion 360 environment